

# The World as Laboratory: The Social Construction of the Bicycle.

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what I felt finally enlarged the choice of experiences. Remember also that their words were not spontaneous. They produced them because we were listening, because we were interested. What they had experienced became all the more interesting for them as we were interested by it.

The influence was thus part of both the choices and the comments. In each case inseparable from it, it was one of the elements of an indeterminate experience. And it does not make the choices and the comments less real or less reliable.

We believe that this new version of the Valins experiment may be more relevant for the subject matter of both Valins and ourselves. Valins' problem was, are we affected by bodily signals or by the way we cognitively interpret those signals, the meaning we assign to them? Thus he could not take into account the singularity of the emotional experience to which our students testified. Emotion is not something that just happens, be it through bodily events or cognition. We care for emotions, and this has a double meaning at the very least: we care for what moves us and we care for the kind of things which we know can move us. In other words, emotions may be cultivated, are cultivated as a matter of fact, and maybe need to be cultivated to play their whole part in our lives. As with all the experiences that are intimately connected with culture, words like "manipulated" or "authentic" may always impoverish the account of experience.

Of course, using our new version of the Valins experiment to propose this, as we do, is not doing science anymore, at least if you take science in the sense of an objective demonstration. It was a device that forced us to learn together, and to explore further ways to cultivate emotions. Our device, therefore, was not really an experimental device in the usual sense of the term: it was more like a device that creates the possibility to meet and to learn about a question.

Of course, we, as the ones who invite and question the subject, still are the ones who choose the constraints, but starting with these constraints, we expected our students to become more able to discuss the experience, to cultivate the questions, and to create new ones. The device, as we chose to construct it, made them think. And this is the success of this experiment. Our experiment did not demonstrate anything, nor did it reveal some secret, hidden truth about emotions: it is a device that aims simply to create interest, to share our interest, and to arouse perplexity and intelligence.

The last problem would be, if our version is useless from an experimental, demonstrative point of view, for whom can it be of use?

First, it can be useful to show that many experiments in laboratory psychology lack robustness. A small change occurs and the demonstrative value is lost, even if the result is kept. Our students did not allow us to demonstrate in their names, they forced us to think and create us as their witnesses.

But this modified version may also be of use not unlike the famous Milgram experience, which showed that in the name of science you can induce quite normal people to torture somebody. Milgram did not demonstrate anything different than what history already told us. He added "the advancement of science" to the long list of those realities in the name of which we can forget ourselves and comply. He did not demonstrate, but he produced an abstract case, which may force us to learn and remember.

Here also, we may have something to learn and remember. We may learn from the contrast between the first stage, in which we produced quite an asymmetric situation, and the second one, in which we no longer had anything to hide, and could share and discuss questions with the students. In other words, we first manipulated, and then proposed an open situation where the students were no longer so-called experimental subjects but people able to understand and share our problem.

What we learned may concern all situations marked by asymmetry, such as the one confronting adults and children, teachers and students, maybe therapists and patients, and finally artists and the public. In all these situations, there may exist a common problem: those who, one way or another, are in charge of the situation, are responsible for it, or have to give account of its issue, or are afraid to manipulate or influence. We see teachers dreaming of children constructing by themselves pieces of knowledge which past generations had a lot of trouble producing. And we see also artists, who try and try to produce something that should create new possibilities of experience, something that would have its own necessity, yet they feel they must leave the public to be the only judge, wishing not to influence, not to interfere. As if the successful encounter with the proposed work had some mystical quality. A true encounter without mediation.

The idea of a true, that is, free, that is, non-influenced, encounter with a proposition, be it knowledge or art, may correspond to something some people do experience sometimes. But it is not a general ideal. As a general ideal, we would say it is pure poison. Just like our students know that in an experimental laboratory, people are deceived, people who visit an art exhibition know that they are meant to taste, and maybe show good taste. As one of our students said, they know a lot from the outset; they are not innocent.

Maybe there is not such a dramatic alternative between the freedom to experiment and "manipulation" or "influence." Perhaps being afraid of influencing produces the worst kind of influence.

Whatever you propose, whatever experience you want to induce, you take the responsibility and ask for consequences.

Maybe a more interesting alternative would be either having people wonder by themselves, without means to cultivate the question "How should I react, what does he want me to experience, feel or think?", or creating the setting where those questions maybe worked together.

Valins' experiment was truly a manipulative one because his subjects, whatever they experienced, were induced to keep silent about it, that is, also not to take it seriously. But our version induced students to take a position and then to discuss the way they did it. Our problem created witnesses, not experimental witnesses, the ground for demonstration, but people able and entitled to discuss the experience and to force us to learn about what we had proposed.

Maybe this is a valid ideal for many situations with an asymmetry, that is, with somebody taking the responsibility of proposing something to someone. How to create the setting in which consequences may be cultivated, in which people who have experienced a proposition may become witnesses for this proposition? It is not agreeing, being convinced, or coming to some kind of a consensus. It is

by having them think we got diversity from our students, not homogeneity. To become a witness for a proposition means at least two things: feeling that you have become able to take a position, and in the act of becoming, feeling that what has been produced, your own becoming, is actually the answer, the only answer the proposition was looking for.

12 A.M. - 1 P.M.

## THE WORLD AS LABORATORY: THE SOCIAL CONSTRUCTION OF THE BICYCLE

Wiebe E. Bijker

**How to understand the strange deviation of the high-wheeled "ordinary" bicycle of the 1870s? After all, centuries earlier, Leonardo da Vinci had already invented the bicycle of the 1970s. Why this silly, dangerous, and unpractical high-wheeled vehicle? Or was it not silly? Did it actually work well? The world is a laboratory. In that laboratory, the "truth" of technology is manufactured. The working of a technology is not the result of laws of nature or the principles of economics. Humans experimenting, in the laboratory called "the world," fabricate the working of machines.**

Scientific knowledge is not discovered, literally, by taking away the cover and then looking into nature and finding facts, it is manufactured by human beings. Shifting from science to technology, the working of a machine is not an intrinsic machine property, but a social accomplishment. The working of a machine is the result of social interactions between people, and—as I will argue and try to demonstrate to you—does not result from laws of nature, economics or whatever. As far as the activities go, scientific and technological work is not restricted to the laboratories and workplaces, but happens continuously and everywhere. This is basically the central idea of this laboratory weekend. Three examples will be used. The bicycle is one, as announced by the title, as well as Internet and nature, to show that the lessons from the bicycle of a hundred years ago can actually be applied to modern technologies and political issues. The background of what is being argued is a reflection of the relationship between the world and technology. A distinction between two kinds of worlds has to be made. The relationship with the natural world is a quite straightforward one, though not as straightforward as it may seem. Other lecturers and experimentalists of this laboratory weekend will argue that it is not as straightforward as is illustrated by my picture.

The picture suggests that from technology to the world, there is the impact of technology. Technology changes the world by building roads and dikes; in other words, it changes the world. At the end of this lecture I will come to an example that is much more precise. It is the other way around; the world, nature, natural law, physical laws, and scientific laws all help to shape technology.

My focus, however, is not on the natural world; my focus is on the social world. What I am fighting throughout this lecture is the concept of technological determinism. In technological determinism, it is first assumed that technology develops autonomously, as if it were a big flywheel that after having gained momentum will roll on forever. Secondly, it is the technological determinist's view that technology determines society, that it has a great impact on society. I am troubled by this view because it is at once both politically debilitating and false. If this view were true, then all public debates about technology could be skipped; thus it is politically debilitating. It is false because technology actually does change as the result of social forces, and furthermore, it can be changed deliberately, strategically, and on the basis of choices that are made by engineers, politicians, and citizens.

Let's take the development of the high-wheeled ordinary bicycle in 1870. What is the problem with this bicycle? To us, it seems a stupid, dangerous, non-efficient machine. However, it was a huge commercial success. What's even stranger, the concept of our modern bicycle with two wheels of equal height was already there in 1493, in Leonardo da Vinci's drawing of the bicycle. This bicycle is basically the same as the one we use today; the only difference is that supposedly da Vinci's was made of wood rather than iron. So why make this detour to this strange, high-wheeled thing? If you assume that technology has its own intrinsic meaning, you must almost inevitably conclude that the engineers of the time, as well as a whole generation of customers, were very stupid. This seems to me a weak argument. So I'll give you another argument for the detour to the big, high-wheeled bicycle.

I will do this by describing the bicycle, by looking more carefully at what this high-wheeled machine is. I am not going to do that with our present knowledge; I am not going to look backward with the benefit of hindsight, knowing what we now have out there on the pavement and rolling through Antwerp. I will describe the bicycle through the eyes of the social groups that were actively engaged with this bicycle, such as women.

For women there were several particular problems with this bicycle. To begin with, in Victorian times, in Britain, women were not supposed to be out on the streets in any sort of public way. On top of this, they were sitting on this bicycle with the wind under their skirts at about the same height as male eyes. So there were very strong moral arguments against women riding a bicycle as men did. The second problem was that skirts would get entangled in the spokes of the wheel, and women would fall head over heels from their bicycles (as would men, when the bicycle met some obstacle on the road). However, women really wanted to ride bicycles. Their interest was so strong that a special, high bicycle for women was designed. The engineer who designed the bicycle argued that if women were allowed to sit sideways on horses, they should also be morally allowed to sit on a bicycle in the same way. So he designed a bicycle on which they could ride without spreading their legs. Another solution were knickerbockers, trousers that looked like a skirt.

The newly designed bicycle, however, was a very dangerous machine. If we tend to fall to the right when riding a bicycle today, we steer our wheel a little to the left and that balances the bicycle. If anything goes wrong, we can hold out our leg and

stand on our right foot. If something happens to these women and they start falling to the right, they can only stick out their arm. But by the time they crash onto the street the force will be so big that probably the arm will break. So if we look through the eyes of this group of users, we see a very tricky machine. This bicycle was not a big success. However, the fact that the engineer and the manufacturer went all the way through designing and manufacturing the thing proves that women had a serious interest in riding bicycles. For women however, the big machine didn't really work, and this is the machine on which I build my argument of the stupidity of detour.

However, if we look through the eyes of another group of users, young men of the usually upper (middle) class, rich and athletic, we get a totally different picture. We do not see an unsafe bicycle; we see a completely different bicycle. We see a macho bicycle.

So if we want to describe a technology such as the high-wheeled bicycle, we do so by looking through the eyes of the socially relevant groups. In this case I mentioned two examples, but typically many more groups will be relevant for understanding a technology. The first example in this case were women. What we see through the eyes of women is a very unsafe bicycle, just as in the cartoon in which you saw a bicycle bouncing downhill, meeting a flock of sheep and catapulting its rider head over heels. You didn't really need a flock of sheep; just a stone on the road or a hole in the road was enough to fall. It was a very unsafe bicycle. But through the eyes of the second relevant social group, the young men, we see the macho machine.

Two different machines. The basic argument is that the one ordinary bicycle, if you look carefully enough, dissolves into two artifacts, into two different machines: the unsafe one and the macho one. I have demonstrated the interpretative flexibility of one technology, of this bicycle, by unpacking the two hidden bicycles. Although I won't elaborate on it, there is a further analysis, using the theoretical term "technological frame." It leaves us with these central concepts: if you want to understand *technology*, you go through the eyes of the *relevant social groups*, you demonstrate the *interpretative flexibility* of the machine. Only in hindsight can we tell that the unsafe bicycle was, as it were, the "winner." That particular identity of the bicycle became so dominant that it became necessary to develop other bicycles.

One could argue that the 1870 bicycle is old technology. Does this analysis also apply to high-tech, modern technology? The bicycle is socially constructed; what about modern technologies? I will use the example of the Internet to argue "Yes, it does apply to modern technologies." More precisely, I mean Internet protocols. Internet protocols are the software that is needed actually to send something successfully from one computer to another. I will not go into too many details, but a few are necessary, as in all these lectures in the laboratory event: as you go into the depths of the laboratory practices, we will now go into the details of Internet protocol design. I'm going to compare two different Internet protocols. Both still exist. I will briefly describe their backgrounds. The one protocol is the TCP/IP protocol, which effectively ended up on the Internet, as we now know it. The other is the X25 protocol, which is still used, but not for the Internet.

I will briefly compare the two. TCP/IP emerged from the American Defense Department ARPA. X25 came from telecom organizations all over the world. What does that mean for the context in which both were designed? TCP/IP aimed at linking large research facilities and information centers. It was designed for very high-performance client computers. These were the mainframe computers of the big laboratories that developed the atomic bomb and the H-bomb, worked on nuclear missiles, etc. The context of the X25 network was exactly the opposite. It worked with very low-level computers at the end of the network, but very big high-capacity computers in the central nodes. That is very similar to the practice of the PTT's telephone exchange (PTT: the Dutch postal, telephone, and telegraph services). The telephones on the wall or on the tables are pretty stupid machines. They can be so stupid because the central telephone exchange is very clever, complicated, and able to do a lot. That is the difference between TCP/IP and X25: sophisticated users and unsophisticated users. It is not just the computers that these users have, but also the expertise to manipulate the computers and to repair problems that may occur in the network.

What requirements do these networks have to meet? The Defense Department required high flexibility. They wanted the researchers in their laboratories to be able to change setups and change the kind of information that they were going to transfer. In the case of the postal organizations, resulting from a century-old tradition of monopoly (monopoly in the sending of letters and other mail, but also a monopoly in telephony and telegraphy), of course, they extended their own ideology of monopoly into this network too. So there was no flexibility; on the contrary, there was uniformity in one fixed standard. The Defense Department wanted to be able to adopt local networks, so within one laboratory there might be a local network that needed to be linked up with this TCP/IP network protocol. The PTT and its X25 protocol had no necessity for that. Simplicity was crucial for Defense; quite understandably, because they were basically reckoning with a situation of war. They didn't want one bomb on one node or one laboratory to incapacitate the whole network. Therefore, the whole network needed to be quite simple, so that with a simple repair work you could get the thing going again. In the case of the PTT, again because of their long tradition and ideology, reliability was much more important. And they were prepared to pay for the reliability by making the network less simple. If you pick up your phone, you really expect, and you can expect, that the whole thing will work. PTT wanted the same kind of reliability for its network. You know that with Internet computers it may sometimes not happen; that is the result of the tradition that built the TCP/IP protocol.

By setting these protocols next to each other, I will try to show you that even something as high-tech as an Internet protocol is not simply straightforwardly derived from laws of informatics, physics, or computer science. Within these networks lies, as if it were baked in, the whole cultural ideology from which they stem. In the case of the Internet protocol TCP/IP, you can trace back the identity of a defense network. In X25 you can trace back the identity of a PTT network. So my argument is that not only the bicycle of a century ago but also the Internet protocols of one decade ago are social constructions. It

works because of social interactions, cultural interactions, and all sorts of non-narrowly technical things. What are the implications of having argued that both old and new sorts of technology, all sorts of technology, are indeed socially constructed?

Let us return to the larger issue at stake this whole weekend, in this series of performances about the laboratory and the world and the sort of gray area between them. Let us do that by focusing on my last example, the construction of nature. We will now move out of technology and argue about the construction of nature, the construction of the world, as if humans were a little bit like God.

Nature is constructed in various ways. First of all, this is done in a very straightforward, scientific sense; biology and ecology are sciences. Within these sciences, scientific knowledge is created, very much along the lines demonstrated in the other lectures during this weekend. Scientific facts are created and socially constructed by interactions between scientists and their experiments, and the readers who pick up scientific journals and comment on those journals. In this way, scientific facts are manufactured, and scientific facts about nature are equally manufactured. As such, in that identity, nature as a set of scientific propositions is socially constructed. But of course nature is also constructed in a much more physical sense: by farmers, engineers, planners, industries... they all are continuously constructing nature. One might argue that they aren't doing it deliberately. One might argue that it's a sort of byproduct of the normal activities that they have. Farmers do not construct nature, they grow wheat, or they have cows in order to produce milk, cheese, etc., and as a result of that, something happens to nature.

My example of the manufacturing of nature is almost a caricature. It is found not very far from here, a little bit to the north, where nature is actually deliberately and strategically manufactured. That is in the Oosterschelde. (Antwerp lies at the Westerschelde.) The Dutch built a big barrier to keep the sea out in case of storm, and behind that barrier they are now busy constructing nature.

That is what I want to show you a brief video about. After that I will return with my conclusion.

(Video showing how man helps nature, trying to create a dune landscape by, for example, digging a lake, creating a humid valley, and protecting the breeding area.)

After the engineers had finished rebuilding the dikes after the 1953 disaster, they were empty-handed. They looked around for what they could build next. They saw nature and started to build nature with their big machines.

There are at least two implications that I would like to draw from the main argument, the argument that a clear divide between science, technology, and the world doesn't exist. (I'm focusing on technology and the world.) My principal argument is that the working of machines is socially constructed, which causes the social and the technical to merge. This has two kinds of implications.

The first are cultural implications. It means that if we take this seriously, we must start to think about education in another way. We must not think about education in a narrow, institutional sense: primary school, secondary school and university. We must also think about events that we are part of during this weekend, *éducation permanente*, life-long learning. This commands the nature of the relation-

ship between technology, the world, and science that people continuously have to learn in a changing world.

There are also political implications, if you accept my arguments that technology is socially constructed and that all kinds of relevant social groups participate in this construction, if you accept that women participated in the construction of the bicycle by not wanting the macho machine but pushing for the unsafe machine; if you accept that environmentalists participated in the construction of the big storm surge barrier in the Oosterschelde and in the construction of nature with the engineers—if you accept all that, there is no longer any reason to give first place to engineers and scientists, when issues of science and technology are at stake.

Somehow we need to think about including other kinds of other expertise. That's the second point. Another way of expressing the first point is that expertise, knowledge, or know-how is not something you can measure along one dimension, along one measuring rope. There are all kinds of expertise, and the expertise of engineers and scientists is very important. There is also the expertise of particular user groups: patient groups in medical technology; environmentalists with the Oosterschelde; unions in safety at work. Those kinds of expertise are equally important, and they are not less qualified than that of the engineers or the scientists. So there is a kind of explosion of kinds of expertise, rather than a dimension of high expertise and one of low expertise, of much knowledge and little knowledge.

Finally, if you take this seriously, I think it is necessary to look for new forms of democracy: new forms of debating the relation between technology and society that I started out with. When putting issues of technology on the political agenda, think about how to involve other groups, how to involve citizens. And the phrase that I am using here, how to combine representational forms of democracy with mobilizing citizens, is a deliberate one. I have chosen the combination deliberately because very often an undue optimism about the Internet infuses this sort of discussion. It makes people argue that, since we have the Internet, everyone can directly participate. For example, if you have a big Internet site in the city of Antwerp, everybody can participate in the discussion and you can even vote electronically by Internet. So you might think about doing away with all forms of parliamentary democracy.

With the Internet, we basically are back at the agora of Athens of two thousand years ago. It is a technologically determinist argument in the sense that it completely neglects the social, historical roots of thinking about democracy. It suggests that just by handing over the Internet to society, a new social setup and a new form of democracy will follow in an almost straightforward line. In its optimism that the Internet will introduce a new form of democracy, this view is technologically determinist. I think that is a pitfall because of all the arguments that I gave, which are a warning against technological determinism.

That is why I am stressing that we need to look for a combination of representational parliamentary forms of democracy and some form of mobilizing these other expertises—the expertise of citizens, the expertise of the environmentalists, the expertise of whoever is involved. There are some nice examples, none of which is really working; yet there is a lot of

experimentation going on in various countries such as the Netherlands and Scandinavia.

I will finish with an example that is linked to this nature development. The Netherlands participated in it a year ago. It is exactly the kind of thing I showed in the video: constructing nature. There is a large program in the Netherlands, actually going from the Oosterschelde all the way up to north of Groningen. In a series of pieces of land, large and small, such as alongside the big rivers, but also places outside the river area, nature is being reconstructed. Farmers have to sell their land back to municipalities or to the government. They are expelled from that region. They have to take their cattle away and find new farms in new polders. Reintroduced into that ex-farmland are big cows from Scotland and horses from Poland that can stay there unattended, even during the winter season. Some even talked of introducing wolves into the area, which made some people there a bit nervous. It hasn't actually been done, but it was a serious proposition.

What happened here? The plan produced a very big political fight. A farmer and his family who had been there for centuries, farmed and nourished the land for centuries, were told that they had to leave because the farm is not "nature." What they had maintained for Friesian cows would now become a place for Polish horses and Scottish cows where vegetation could grow wild. This raised a huge political controversy. But it was not just a political controversy; it was also a technological controversy; there was a lot of technology involved. You saw some of it on the video, but much larger systemic technologies were also involved. The ground water level needed to be modified, so big water-management systems were put in place to recreate that so-called old-time original nature. So it was a lot of technology, it meant a lot of political fight, and what happened?

The Dutch got stuck. The parliament didn't know how to deal with this issue. They then asked us to develop an experimental form of combining scientific engineering expertise with all these groups of farmers, citizens, and families who wanted to ride their bikes through nature on Sunday, to mobilize the expertise of those groups. We organized a "public debate." This consisted of a series of events: big conferences, small workshops, field site visits for a group of forty citizens from the Netherlands who were selected the way an American jury is selected for a trial. So forty Dutch citizens were selected according to a variety of criteria. There were scientists among them, and there were single mothers who had no clue about biology but simply wanted their children to be able to play outside on Sunday. All sorts of Dutch women and men were included. That group of forty was asked to go through a whole series of events, lectures and workshops, field site visits and political debates, and at the end, to express their balanced opinions. That collective balanced opinion was then given to the parliament and it was hoped that it would do something with it. That was the experiment.

How did it end? It ended in a very ambivalent sense. Positive is that it actually worked, in the sense that this very heterogeneous group of forty Dutch people was able to discuss things with one another. They were able to debate the issue at hand, in new ways based on their own backgrounds and expertise and with the input of all sorts of scientific and

technical information. Also on the positive side of the balance was that they actually succeeded in reaching some sort of consensus at the end, some sort of commonly shared advice to the parliament. On the negative side of the balance is that then the parliament did not know what to do with it. The public debate had neither a clear mandate nor a clear position in the political parliamentary structure of the Netherlands, and although the parliament was given fairly clear advice based on the whole process, the advice dropped dead. Within the parliamentary system it was unclear how a "jury's verdict" could play a role. It was thus a very mixed experience. In principle, it could have been done. But practically, it can't be done without tinkering with the basic political representation structure. I finished on a very explicit political tone to show that my basic argument—that scientific facts are socially constructed, that technology is socially constructed, as was the bicycle, as are Internet protocols, as is nature—does actually have concrete, pertinent implications, relevant in this day and in this world, even in a political sense.

Audience: What was the opinion of those forty selected Dutch citizens?

Bijker: First I will tell you what we as organizers feared. We were afraid that the group would move relatively quickly towards the argument that is presently very much en vogue, also when you look at the Dutch press: "Let's get back to real nature." Biologists can tell you, however, that it is very unclear what real nature is. Do you go back two thousand years? Do you go back five thousand years? If you go back five thousand years, it would be the same as drowning all of the Netherlands and having to move back to Germany, because the Netherlands was simply a part of the North Sea. It is very shaky what "back to real nature" actually means. However, that was the main thrust of all publications at that time, and we were afraid that the whole group would quickly move down that path. Not that we were against that path, but we were nervous that they would not go there on the basis of their own arguments but basically because they already knew "the answer."

They didn't do that. That is partly why we think we can legitimately state that they came to their own conclusion, because it was a fairly counter-intuitive one. It really took them a whole night of fighting with each other, and the conclusion was that they did not want to accept one definition of nature. They invented new terms to classify nature. They introduced and manufactured them themselves, without drawing on scientific literature. They came up with terms like "city-nature," pointing not only to parks, but also to the big green areas between old blocks of houses, where for one or two centuries a particular kind of ecology has developed. Thus they introduced a classification of nature. Their basic argument was "We want that diversity." We do not want the diversity of the ecologists, who argue that we need to get rid of the farmers because of the ecological diversity of species. We do not accept that, because that would mean destroying farmers' nature, destroying city-nature. We want diversity including farmers' nature and city-nature. They really invented that themselves. The citizens who knew nothing about biology but simply argued starting from what they wanted with nature in the Netherlands, arguing with the ecologists and the biologists in the panel. We were quite pleased with

it because it showed that this group could actually come up with an original idea, fight about it, and then come up with advice.

Audience: Would it be possible to repeat the experiment anywhere else than in the Netherlands?

You have a culture of commissioning, of fighting, of debate. But in some countries it is, at this time, very worthwhile conserving what there is, such as Panama, which is going downhill very quickly, as it is in other countries that are very rich in diversity. It is impossible to do this kind of informing the power by a heterogeneous group. I think it is impossible even in Belgium.

Bijker: I partly agree, and partly disagree. I have been arguing that technology is socially constructed and that you cannot evaluate technology without taking into account its context. So I would be stupid if I would argue that a democratic idea could be evaluated outside of its context. So in that sense you are completely right; you cannot think about these kinds of political experiments outside the political culture in which you apply them and where they emerge. So in that sense this is extremely Dutch and could only be invented in the Netherlands and only work in the Netherlands.

Audience: Or in Scandinavia.

Bijker: Exactly, or in Scandinavia. And on that point I do agree with you and at least whatever I say, we need to be extremely careful in taking this model and going to another political country to try it there. But I also disagree with you. In other countries, such as France, which is even more authoritarian than Belgium, but also in the United States, there is a growing awareness that the existing political culture, the existing way of managing scientific knowledge and technology does not work—even in the United States, where there is such an extreme, adversarial culture that when a doctor cuts your finger by mistake, you go to court and sue him. When new norms for paint need to be defined the government agency declares them, the painting industry and the consumer groups declare the other norms, and they fight about it in court. Now even in that adversarial culture, completely contrary to Dutch culture, they now have decided that this doesn't work. The Americans are now actually setting up consensus conferences; they almost call it that literally. They are trying to work with it and they find it extremely difficult. You are right, that would be your prediction; the Americans do not have a political culture like that. They will find it very difficult to handle. They find it difficult, but they still feel that they need to try something.

The same is true of France. Bruno Latour told me about some experiments with local water management boards. Again, as far as I can see, this is completely in contrast with the very top-down directed École Nationale Supérieure style of political management in France. On issues of local water management it can be pretty important and politically sensitive. There has been an experiment going on for four or five years in which groups of citizens convene with engineers, hydrologists, and so on. I don't know the details of the project, but it does show that apart from the political culture argument that you make and I agree with, there is another argument. My main argument is that the character of technology almost obliges, pushes you to think differently about the political handling of technology. There must be something to it, or political cultures like the United States or France wouldn't start trying

to do it. So it's a mixed message: I think we have to go down that road, but it will be very different in different political cultures.

You referred to Panama. I don't know anything particular about Panama, but I can imagine certain situations. Well, I know just a little bit, but only from newspaper reports, for example about Shell operating in Nigeria. That's why I deliberately said that I don't want to put my stakes on the Internet. I want to hold on to something like a representational democracy. I want it to be possible that someone pretty forceful, like UNO, at some point says "Stop here, we have some sort of higher principles," for example, that industries are not allowed to take control of the politics in a country. You would not be able to do that by Internet because most of the people in Nigeria don't have Internet.

3 P.M. - 4 P.M.

### ON SPONTANEOUS GENERATION: LOUIS PASTEUR'S SORBONNE LECTURE OF 1864

Bruno Latour

Louis Pasteur, in his search for microbes, had to fight his way through a very common idea at the time, that is, the spontaneous generation of animalcules in food and water. His dispute with Félix-Archimède Pouchet, who had proven the existence of this fact, became famous. In 1864 at the Sorbonne, in the middle of "le tout Paris," Pasteur gave a public lecture on the topic to prove that spontaneous generation is simply the result of bad experimental practice. Pasteur's abridged text is presented here, together with some of the simple experiments he devised to get his point across. At the end of the lecture several comments are made on Pasteur's method and experiences.

An address delivered by Louis Pasteur at the  
Sorbonne Scientific Soirée of April 7, 1864  
Gentlemen!

A number of imposing problems now have our best minds in thrall. These include questions regarding the unity or plurality of the races of Man, whether his creation ought to be dated thousands of years or thousands of centuries past, whether species are fixed, or rather undergo a slow, progressive transformation into new species, how supposedly eternal matter relates to the nothingness outside of it, and whether the idea of God is useless. These are just a few of the issues now subject to learned debate.

You need, however, have no fear that my address tonight has any pretensions toward resolving any one of these earnest questions. But, in the neighborhood of such mysteries lies another question, more or less closely related, to which I may, perhaps, venture to direct your attention; for its complexities, which I have made the object of concerted and conscientious study, are accessible to experiment. This is the question of what we call "spontaneous generation."